Jim Byrn's Slough L987 Lateral Water Quality Report

January 2008

Introduction

The Jim Byrn's Slough (JBS) begins at a diversion located 10 miles below Magic Reservoir. The slough then flows for approximately 17 miles before entering the Little Wood River (LWR). The stretch of the LWR that the JBS enters is currently on the Idaho 303(d) list (Claire 2005) for sediment, phosphorous and bacteria (Claire 2005; Table 1). A sediment Total Maximum Daily Load (TMDL) was not developed for this reach. However, to maintain water quality targets, monthly sediment concentration averages are not to exceed 50 mg/L (Clair 2005).

Previous monitoring had indicated that the JBS may be adversely affecting water quality in the LWR (Dallon 2005; Monek 2006). The monitoring performed in 2006 identified four potential sources of pollution to the JBS in the Richfield, Idaho area. Of these sources, the L987 drain was shown to have the greatest impact on water quality in the area.

Table 1. TMDL targets for the Little Wood River.

Pollutant	TMDL Target
Suspended Sediment	50 mg/L monthly average
Phosphorous	0.10 mg/L
Escherichia coli	576 cfu/100 mL Secondary Contact Recreation (SCR)
Temperature	13 °C SS (Oct.- May); 22 °C CWAB (June- Sept.)

The L987 lateral drains approximately 1,685 acres. Sediment, phosphorous, and bacteria levels were found to be substantially higher in this lateral than any other waterbodies entering the JBS. In 2006, this drain contributed over 185 tons of sediment and 1,800 pounds of total phosphorous to the JBS. The exact area and sources of the pollution, however, were still unclear.

Initially, two issues were thought to be potentially contributing to the poor water quality. First, during multiple occasions, local residents had witnessed hundreds of gallons of cheese waste being discharged into a bubble screen near the intersection of 1170 N and 1250 East on a regular basis. These discharges emanated from a tanker truck believed to be carrying the waste from a local cheese production facility. It was believed that this waste may have been adversely affecting water quality in the area. After discussion with Idaho Department of Environmental Quality (IDEQ) and Idaho State Department of Agriculture (ISDA) staff during the summer of 2007, it was determined that the waste was a soil and plant amendment registered with ISDA. Secondly, it was thought that phosphorous might be getting into the lateral from irrigation practices to the west of 1250 E near L3c. Local residents have reported that fields in this area are watered with lagoon waste from a nearby dairy operation. This water may be high in phosphorous and the topography of the area is such that the local fields slope 4-5% into a nearby drain.

In February 2007, the Wood River Soil and Water Conservation District (SWCD) expressed interest to the Idaho Association of Soil Conservation Districts (IASCD) in continuing to collect water quality information on Lateral 987. It was decided that the sources of pollutants for the L987 should be determined.

Four monitoring locations were identified to assist in determining critical areas of concern. Monitoring began in May of 2007 and was conducted until the end of the irrigation season. Irrigation water stopped flowing on August 17th 2007, but resumed for 7 more days commencing on September 10th 2007. Sampling was not performed during this last week of irrigation in September.

Discharge, temperature, dissolved oxygen, conductivity, suspended sediment concentration (SSC), total phosphorous (TP), orthophosphorous (OP), bacteria (*E. coli*), and temperature were gathered for the entire irrigation season; nitrate (NO_3) samples were also taken for the first four monitoring periods. Descriptions of all monitoring locations are presented in Figure 1 and Table 2.

Because Lateral 987 is not a free-flowing water body, it is not subject to the water quality criteria set forth by the LWR TMDL. However, water leaving this lateral does ultimately enter the LWR. Therefore, the lateral's water quality should be taken into account if improving water quality in the LWR is desired. The LWR TMDL water quality targets will be used in this report as a starting point for describing 'acceptable' water quality.

Figure 1. Location of monitoring sites.

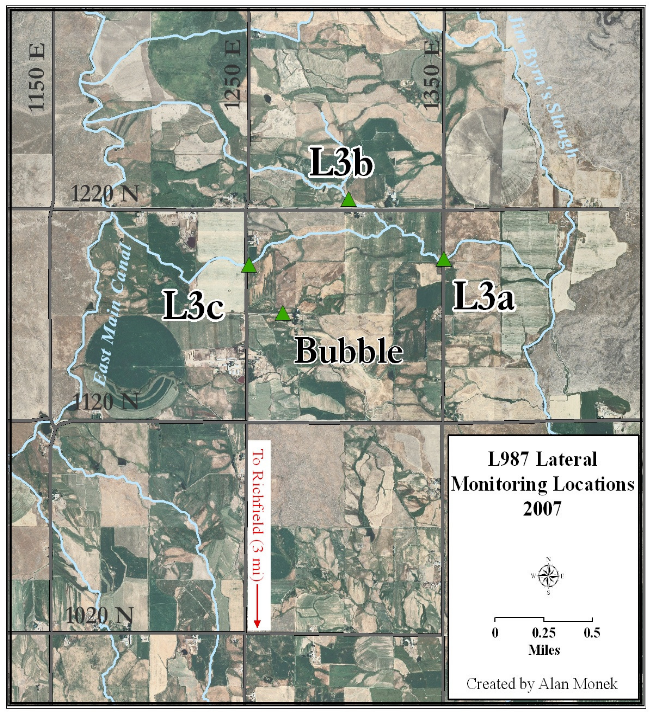

Table 2. Descriptions of monitoring locations.

Site	Description
L3a	On the L987 canal below 1350E road crossing (lowest site)
L3b	On L987 canal above 1220N road crossing (upper site)
L3c	On drain canal below 1250E road crossing
Bubble	10m below aeration screen

Results

Discharge

Discharge generally ranged between 5-10 cfs at the two sites located on Lateral 987—with the majority of flow at L3a coming from L3b (Figure 3). Flows at the drain entering from the east (L3c) were generally low or stagnant. Although only four flow measurements were taken in the ditch below the bubble screen, flow at this location appeared rather variable. If the fields to the east of L3a were being irrigated, flow below the bubble screen would range between 1-3 cfs. However, the ditch was often dry when no irrigation was in progress. The highest flow measurement was 10.9 cfs and was taken at the upper L987 site (L3b) on July 30, 2007.

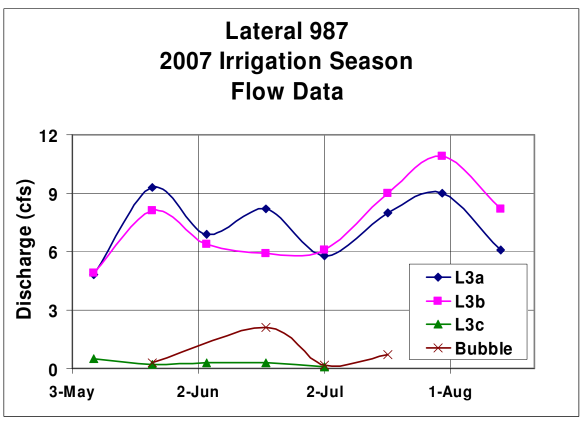

Figure 3. Discharge data for all monitoring sites on the days monitoring was performed.

Average discharge at the lowest monitoring location (L3a) in 2006 was 8.6 cfs. This value decreased by 17% to 7.3 cfs in 2007 (Monek 2006).

Sediment

Suspended sediment concentrations (SSC) were very high in the beginning of the irrigation season and then dropped as the season progressed (Figure 4). The highest measurement was 133.3 mg/L at L3c on May 8, 2007 and was probably due to the initial startup and flushing of the system.

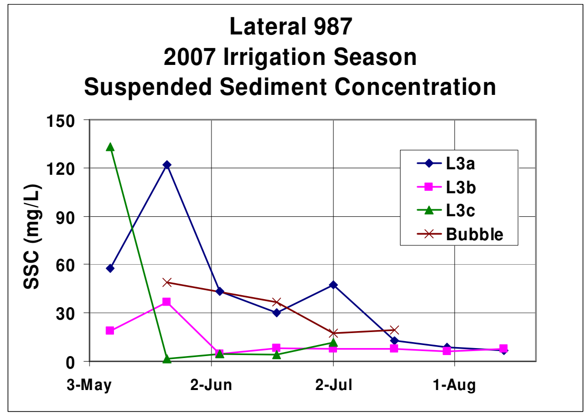

Figure 4. Sediment concentrations for all monitoring locations near the LWR bypass structure.

Mean sediment concentration for the irrigation season at L3a fell from 50.0 mg/L in 2006 to 41.9 mg/L in 2007 (Monek 2006). This represented an average decrease of 19%. As stated earlier, the LWR TMDL sediment target for the reach of LWR in this area is a monthly average not to exceed 50 mg/L. This target was exceeded for the month of May in 2007.

Except for the initial high SSC values on the first monitoring day, L3a had the highest sediment concentrations for all other monitoring dates. This would suggest that water quality continues to deteriorate as water flows downward through the system.

The majority of the sediment, however, does not seem to be originating from L3b or L3c. Although the bubble screen site appears to have significant sediment concentration issues, flow at this site is generally very low and also must first flow through a wetland before entering Lateral 987 above the L3a. Water leaving the bubble screen likely has little impact on water quality at this lower site. Data and observation indicate that much of the sediment pollution found at L3a is occurring directly above the lower monitoring site (L3a).

With the assistance of Kevin Davidson from the Natural Resource Conservation Service (NRCS), the reach of lateral between the lower site (L3a) and the two upper sites (L3b and L3c) was visually inspected. It was determined that the current land use practice of cattle grazing had adversely impacted the stability of the banks. Cattle-induced stream bank trampling, coupled with high water velocities and a low water table within the reach, had resulted in lateral cutting along the banks and several small head cuts. It appears that the best way to improve water quality below this reach is to either change land use patterns or to implement Best Management Practices (BMPs) to mitigate the impact of cattle on riparian vegetation and streambank stability.

Phosphorous

Total phosphorous (TP) and ortho-phosphorous (OP) were collected at all sites. The highest TP concentration seen in the study was 1.26 mg/L at the 'Bubble' site on May 22, 2007. With the exception of this one data point, TP concentrations in the area remained relatively constant (Figure 6). The average seasonal TP values for L3a, L3b, and L3c were 0.14 mg/L, 0.08 mg/L, and 0.26 mg/L, respectively. TP values at L3a and L3c were substantially higher than the instantaneous target of 0.10 mg/L set forth by the LWR TMDL (Claire 2005).

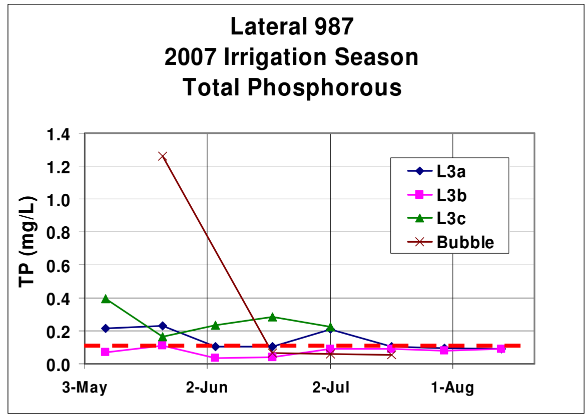

Figure 6. Total Phosphorous (TP) data for all monitoring sites on the days monitoring was performed. The dashed red line represents the LWR TMDL 0.10 mg/L target for TP for the impacted reach of the LWR.

Mean TP concentration for the irrigation season at L3a fell from 0.26 mg/L in 2006 to 0.14 mg/L in 2007 (Monek 2006). This represented a 55% decrease from the previous season. Declining SSC values in 2007 were partially responsible for this decrease, however, average ortho-phosphorous concentrations at L3a also decreased by over 51% for the same period.

Orthophosphorous represents the portion of TP that is not bound by soil particles and is therefore available to plants. The highest OP value recorded in the 2007 study was 0.331 mg/L at the bubble screen site.

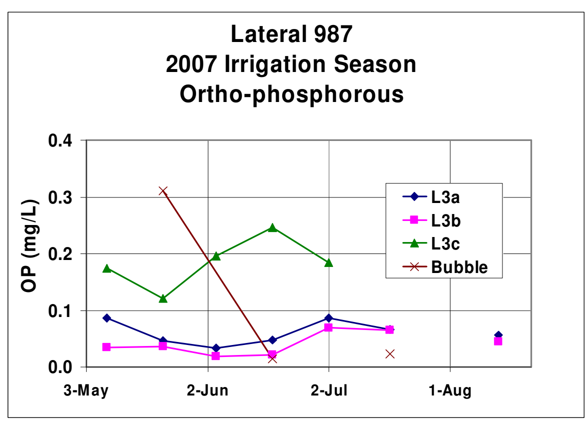

Figure 7. Ortho-phosphorous (TP) data for all monitoring sites on the days monitoring was performed.

An elevated ratio of orthophosphorous (OP) to TP seen at L3c suggests a much higher groundwater component at this site and would reinforce the hypothesis that irrigated lagoon wastes may be entering the lateral drain via shallow groundwater returns into the drain. The average ratio of OP to TP was nearly double that seen at the other monitoring locations within the study area.

The high spike in TP and OP seen at the bubble screen site seemed to correspond with the local residents' observations of cheese byproduct being discharged into the system. Investigation into the issue with the ISDA and IDEQ revealed that this substance is registered with the ISDA as a soil amendment. At present, direct land application is the only acceptable method of delivery for this substance.

Nitrates

Nitrate samples were taken intermittently at all locations throughout the season. Nitrate levels were consistently low at all locations. Values ranged from non-detect to 0.60 mg/L. Because nitrate concentrations did not seem to be an issue in the system, they will not be addressed in this report.

Temperature

As stated earlier, Lateral 987 is not a free-flowing water body; therefore, it is not subject to the water quality criteria set forth by the LWR TMDL. By their very nature, laterals and canals are prone to high water temperatures, due to the lack of shade and flow alteration associated with them. However, inputs from this lateral and the Jim Byrn's Slough (JBS) undoubtedly impact water quality in the LWR below. Also, the JBS is widely known to provide fish habitat. Temperature will therefore be discussed briefly.

The LWR has been identified as a primary recreation, cold-water salmonid spawning river. For streams of this type, Idaho law requires that instantaneous stream temperature shall not exceed 13° C during critical spawning periods (May 1 – June 30, September 15 – November 15) and shall not exceed 22° C during the remainder of the year (IDEQ 2002).

The LWR temperature criteria were exceeded 50% of the time at all locations monitored in Lateral 987. No temperature measurements were taken below the bubble screen (Figure 8). It must be noted that these temperature readings should be taken as conservative. Sites were almost always sampled before 1 pm—well before the warmest part of the day. It is therefore likely that water temperatures at these locations exceeded the state standard far more often than was documented.

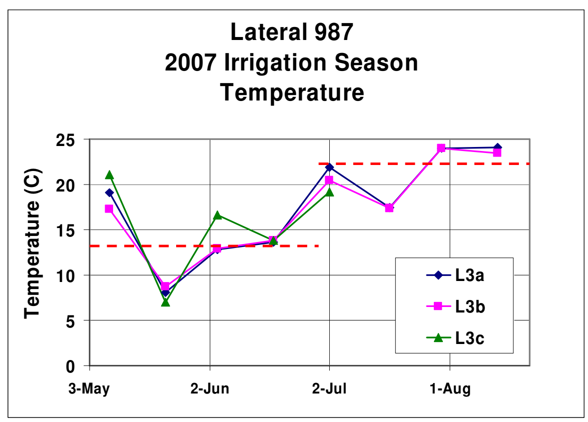

Figure 8. Instantaneous temperature data for all monitoring sites. The dashed red line represents temperature criteria at corresponding times in the year.

Due to a bypass structure installed in the 1990s on at the lower end of the JBS which causes the majority of the discharge from the JBS to be diverted into the Dietrich Canal, the JBS appears to have little, if any, impact on temperature in the LWR (Monek 2007).

No significant change in water temperature was observed in the L987 area between the 2006 and 2007 studies.

Bacteria

E. coli bacteria grab samples were collected at all monitoring locations except at the bubble screen site. The highest concentration of bacteria was 2,400 colony forming units (cfu)/100 mL and was found at the L3a site on May 8, 2007 (Figure 9). This site was the largest offender of the bacteria criterion and exceeded the state criteria for secondary contact recreation for 75% of the samples. Figure 9 also conveys the relatively low bacteria levels found at L3b and L3c. Although L3b is the major contributor of flow and only one-half of a mile upstream of L3a, bacteria values at L3b exceeded the water quality standard only 38% of the time.

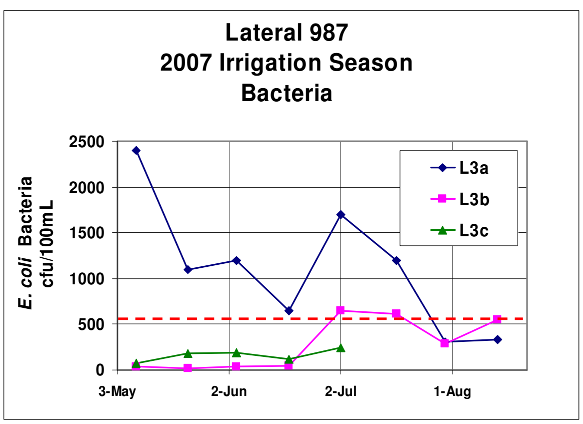

Figure 9. Bacteria (*E. coli*) data for Lateral 987. The dashed red line represents the LWR TMDL bacteria target of 576 cfu/100 mL for secondary recreational contact (IDEQ 2002).

The consistently high bacteria concentrations at L3a were undoubtedly a reflection of the number of cows directly above the site. It was not uncommon to see 70 to 100 cows in this field—often in close proximity to the water in an attempt to avoid the oppressive heat characteristic of the area.

No significant change in bacteria concentrations was observed between the 2006 and 2007 studies.

Conclusions and Recommendations

This study identified three primary areas of concern: 1) directly west (upstream) of the L3a monitoring location, 2) directly west of the L3c monitoring location, and 3) at the bubble screen located 100m east of 1250 E. Each of these locations seems to contribute to water quality impairment in slightly different ways. The site west of L3a is adversely affecting water quality through sediment and bacteria inputs. L3c and the bubble site appear to be introducing phosphorous into the system.

At the L3a site, average sediment concentrations decreased by 19% to 50 mg/L and average TP decreased 55% between 2006 and 2007; however, sediment and TP concentrations remain well above LWR TMDL targets. It is not know whether changes in land use or natural variation within the system are responsible for these decreases.

Although bacteria did not increase by any appreciable amount at L3a from 2006 to 2007, it remains over twice the target set forth by the LWR TMDL. Temperature was also found to be above the acceptable state criterion for free-flowing systems. However, due to the inherent characteristics of canal systems, it is unlikely that much can be done to address this issue.

The majority of sediment and bacteria in the lower section of Lateral 987 at L3a appears to be coming from the land parcel directly west of the monitoring location. This is likely due to the large number of cattle on the parcel above. Cattle were seen numerous times trampling the banks of the lateral as well as urinating and defecating directly into the stream. Fencing, off-site watering and other strategies that limit access to the waterway could improve water quality in this area. Additionally, construction of a settling pond or wetland between this area and the JBS could facilitate the absorption of some of the pollution generated in the upper watershed and supply wildlife with extra habitat in the area

High orthophosphorous levels were detected at both L3c and the bubble screen location. It has been suggested that the fields above the L3c site have been sprinkler irrigated with wastewater from a nearby lagoon. It appears that much of this dissolved phosphorous, either through surface or ground water pathways, is making it into the system. Changing irrigation practices and/ or crop types might be helpful. Also, a review of nutrient management by ISDA and the local land owner might be adopted to address this issue.

The bubble site poses some interesting questions. Cheese byproducts were seen being discharged into the canal system at this site numerous times by local residents. The extremely high peaks of 1.26 mg/L in TP and 0.331 mg/L in OP seemed to coincide with one of these discharges. Currently, this byproduct is registered with the ISDA as a soil amendment. Currently, the only acceptable application method for this substance is through direct land application. Therefore, the addition of the byproduct to the canal system should be discontinued. Further investigation by DEQ and ISDA in 2008 is recommended. It is recommended that a field sample of this byproduct be collected to verify that the substance meets the ISDA guidelines for the soil amendment classification, and that that proper application technique is reviewed for compliance with state laws, and rules.

Cited Works

Claire, J. Little Wood River TMDL, 2005.

Dallon, M. Middle Little Wood River Water Quality Monitoring Report, 2005.

Idaho Department of Environmental Quality, Water Body Assessment Guidance-Second Edition, 2002.

Monek, A. Jim Byrn's Slough Water Quality Monitoring Report, 2006.